CLAIMS: (J.T. Lin)

I claim:

1. A method of performing refractive surgery by reshaping a portion of corneal tissue, said method comprising the steps of:

selecting a gas laser having a pulsed output beam of predetermined mid-IR wavelength and having an energy per pulse less than 15 mJ on the corneal surface;

selecting a beam spot controller mechanism, said spot controller to reduce and focus said selected laser beam to a predetermined spot size on the corneal surface;

selecting a scanning mechanism for scanning said selected laser output beam;

coupling said laser beam to a scanning device for scanning said laser beam over a predetermined corneal surface area to remove corneal tissue, whereby a patient's vision is corrected by reshaping the cornea.

2. A method of claim 1, in which the said selected laser is a gas laser having an output wavelength of about (2.7-3.2) microns, energy per pulse of about (2-15) mJ on the corneal surface, repetition rate at about (20-500) Hz and a pulse duration of about (10-150) nanoseconds.

3. The method of claim 1, in which the said selected gas laser includes a pulsed radiation generated by transverse electrical discharge in a mixture of neutral gases including at least helium gas.

4. A method of claim 1, in which the said selected laser is a pulsed carbon dioxide laser which is frequency-doubled to a beam having an output wavelength of about (5.6-6.2) microns, energy per pulse of about (2-15) mJ on the corneal surface, repetition rate at about (20-500) Hz and a pulse duration of about (10-150) nanoseconds.

5. The method of claim 1, in which the said spot controller consists of an internal magnetic coupler integrated inside the laser cavity having a pin-hole size of about (2-10) mm and the output beam is focused to a spot size of about (0.05-2.5) mm on the corneal surface.

6. The method of claim 1, in which the hydration level of the corneal surface is controlled by a gas blower during the tissue ablation procedure.

7. A method for improving presbyopic patient's vision by removing a portion of the sclera ciliary tissue from an eye of a patient, said method comprising the steps of:

selecting an ablative laser beam for removing sclera tissue, said ablative laser which is focused to a spot size of about (5-500) microns on the corneal surface;

selecting a scanning mechanism for scanning said laser output beam;

coupling said laser beam to a scanning device for scanning said laser beam over a predetermined corneal limbus area to remove said sclera ciliary tissue, whereby a patient's vision is improved by sclera expansion of the cornea.

8. A method of claim 7, in which the said ablative laser is a gas laser having an output wavelength of about (2.7-3.2) microns, energy per pulse of about (0.5-15) mJ on corneal surface and a pulse duration less than 150 nanoseconds;

9. A method of claim 7, in which the said ablative laser is a mid-IR solid-state laser having a wavelength of about (2.7-3.2) microns and a pulse duration less than 150 nanoseconds.

10. The method of claim 7, in which the said ablative laser includes pulsed radiation generated by transverse electrical discharge carbon dioxide laser which is frequency-doubled into a laser having a wavelength of about (5.6-6.2) microns, energy per pulse of about (2-15) mJ on the corneal surface and a pulse duration less than 150 nanoseconds; AF 9/18/2000

11. A method of claim 7, in which the said ablative laser is a diode laser having a wavelength of about 980 nm and having a pulse duration less than 200 microseconds.

12. A method of claim 7, in which the said ablative laser is a diode laser having a wavelength of about (1.4 - 2.1) microns and a pulse duration less than 200 microseconds.

13. A method of claim 7, in which the said ablative laser is a diode-pumped Er:YAG laser having a wavelength about 2.9 microns and a pulse duration less than 500 microseconds.

14. A method of claim 7, in which the said ablative laser is an ultraviolet laser having a wavelength of about (190-310) nm and a pulse duration less than 100 nanoseconds.

15. A method of claim 7, in which the said sclera tissue is coagulated by a laser having a wavelength of about (0.5-3.2) microns, an average power of about (0.1-5.0) W on the corneal surface, spot size of about (0.1-1.0) mm, and a pulse duration longer than about 200 microseconds.

16. A method of claim 7, in which the said ablative laser is fiber-coupled and combined with a coagulation laser and delivered to the corneal surface.

17. A method of claim 7, in which the said sclera ciliary tissue is ablated in radial patterns having a length about (2.5-3.5) mm and a depth about (400-700) microns.

18. A method of claim 7, in which the said sclera ciliary tissue is ablated in radial patterns by a computer-controlled scanning mechanism.

19. A method of claim 7, in which the said sclera ciliary tissue is ablated in radial patterns by a translation mechanism.

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